THREE NEW SPECIES OF NEARCTIC *ISOPERLA* (PLECOPTERA)[1]

Stanley W. Szczytko[2] and Kenneth W. Stewart[3]

Abstract.— Nymphs and adults of three new species of *Isoperla* are described from reared material. *I. sagittata* is known only from southeastern Texas, *I. coushatta* has been collected in East Texas and Oklahoma, and *I. jewetti* occurs in the Basin and Range Mountains of West Texas. The male aedeagii, female subgenital plates, and nymphal mouthparts are diagnostic in all three species.

Stewart et al. (1974) indicated that eastern Texas collections of *Isoperla* appeared close to *I. namata* Frison and *I. mohri* Frison and that further study including comparisons with types was needed. They suggested that *I. longiseta* Banks, collected in 1939 by H. H. and J. A. Ross near El Paso, Texas, should be reexamined in light of Frison's "reluctant" identification, the brachypterous condition of the males and the similarities to *I. mormona* Banks that he mentioned.

Additional collecting and rearing has been done in eastern Texas over the past two years, and all reared, adult, and nymphal material has been compared with paratypes and nymphs of similar species *I. mohri*, *I. namata*, *I. richardsoni* Frison, *I. burksi* Frison, and *I. davisi* James, borrowed from the Illinois Natural History Survey. These studies emphasizing comparisons of male aedeagii, color patterns, male paraprocts, female subgenital plates, and nymphal mouthparts have revealed two previously undescribed species of *Isoperla* from East Texas.

The eight vials of *Isoperla*, labeled *I. longiseta* by Frison in 1942 constituting the 1939 El Paso collection, were obtained from S. G. Jewett, Jr. and the Illinois Natural History Survey. The aedeagus of one male had been extruded and fixed, apparently at time of collection. Adult specimens and eggs dissected from females were compared with those of typical *I. longiseta* from the Green River in Utah and *I. mormona* from Wyoming. The one brachypterous male from La Veta Pass, Colorado, mentioned by Frison (1942) was also borrowed from the Illinois Natural History Survey and examined. The aedeagus of *I. longiseta* males from Utah were extruded for study by clearing in a warm solution of 10% KOH and gently pressing the abdomen. The mouthparts of the four nymphal exuvia were studied and compared with nymphs from the Green River, Utah (the nymphs of *I. longiseta* are undescribed). These studies have confirmed that these *Isoperla* specimens from west Texas constitute an undescribed species.

We thank Dr. Richard W. Baumann of Brigham Young University and Dr. Peter Zwick of the Max Planck Limnology Institute in West Germany for helpful suggestions during the course of this research and especially during preparation of the manuscript.

Isoperla coushatta, n. sp.

Male.— Body length 6.0-7.0 mm, to tip of wings 8.5-9.5 mm. Lobe on posterior abdominal sternum 9 narrow at base with truncate apex (Fig. 3). Paraprocts curving inward and upward, only to posterior margin of tergum 10, broad at base, heavily sclerotized with apex curving outward (Fig. 1). Aedeagus stalked, entirely membranous, with one small double lobe ventrally, and a large dome-shaped dorsal lobe (Figs. 1-3). Abdomen cream yellow. Cerci dark brown. Head pattern variable, but usually with dark ocellular triangle. Pronotum with median light band similar to *I. mohri* as described by Frison (1935).

Female.— Body length 7.5-9.0 mm, to tip of wings 9.5-11.0 mm. Eighth sternum produced posteriorly into a triangular subgenital plate covering not more than one-third sternum 8; width at base three-fourths width of sternum 9 (Fig. 4). Color pattern similar to male.

Nymph.— Abdomen with three dark prominent dorsal longitudinal stripes, two lateral and one median; two lighter stripes

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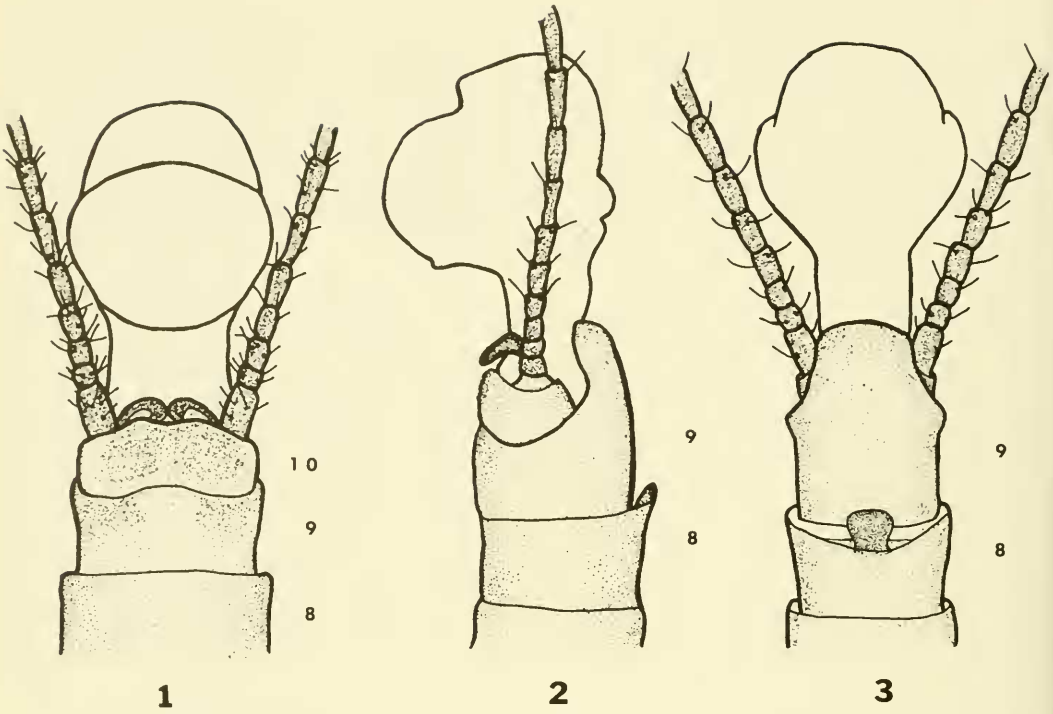
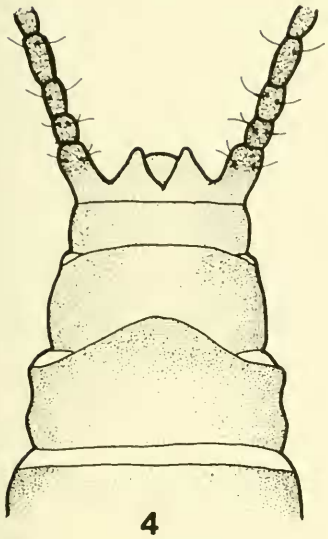


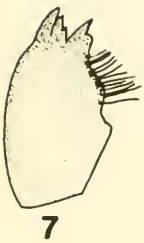
Figs. 1-3. *Isoperla coushatta* male terminalia with aedeagus extruded: 1, dorsal aspect; 2, lateral aspect; 3, ventral aspect.

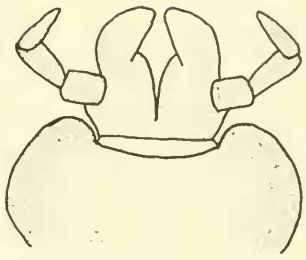
between each lateral and median stripe. Head pattern variable, generally with a dark ocellar triangle. Pronotum with light median band as described for *I. mohri* (Frison 1935). Lacinia with two teeth, subapical tooth one-fourth to one-half length of apical tooth. Hairs continuing entire length of inner margin (Fig. 5). Labrum with median swelling (Fig. 6). Left mandible with five short, stout apical teeth (Fig. 7); paraglossae slender, length approximately 1.5 times width of base; glossae not produced upward at apex (Fig. 8). Posterior margin of abdominal segments with continuous row of hairs.

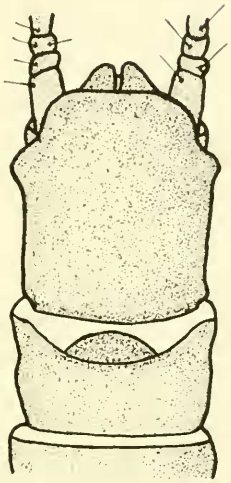
Material.— Male holotype, Saddler Creek, Anderson County, Texas, 30-III-1974, S. W. Szczytko and K. W. Stewart; female allotype, Caney Creek, Montgomery County, Texas, 20-III-1974, S. W. Szczytko and K. W. Stewart. Paratypes: 35 nymphs, Highway 282, 3.5 miles W Junct. 19, Anderson County, Texas, 30-III-1974, S. W. Szczytko and K. W. Stewart; 6 males and 6 females, 28 nymphs, 31 exuviae, Highway 287 W Palestine, Anderson County, Texas, 29-II-1975, S. W. Szczytko; 8 females and 3 exuviae, Highway 8, 6 miles N Linden, Cass County, Texas, 14-IV-1973, S. W. Szczytko and K. W. Stewart; 5 males, 2 females, 12 nymphs, 9 exuviae, Highway 294 E Alto, Cherokee County, Texas, 21-II-1975, S. W. Szczytko and K. W. Stewart; 2 females, Naconiche Creek, Highway 59, Nacogdoches County, Texas, 30-III-1974, S. W. Szczytko and K. W. Stewart; 2 females, 1 nymph, 1 exuviae, Little Cow Creek, Newton County, Texas, 22-II-1975, S. W. Szczytko; 2 nymphs, Highway 87, 3 miles S Junct. 21, Sabine County, Texas, 14-III-1973, S. W. Szczytko and K. W. Stewart; 2 nymphs, Highway 87, 4 miles E Milam, Sabine County, Texas, 19-III-1973, S. W. Szczytko; 1 nymph and 1 exuviae, Huana Creek, Shelby County, Texas, 29-II-1975, S. W. Szczytko and K. W. Stewart.

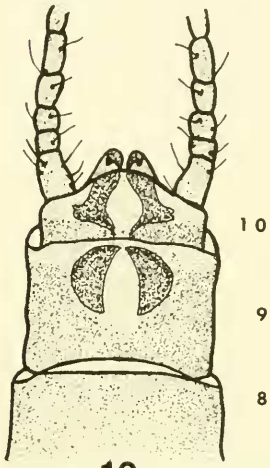
The holotype and allotype are deposited in the U.S. National Museum of Natural History, along with two paratypes of each sex and five nymphs. Paratypes are also deposited in the North Texas State Uni-

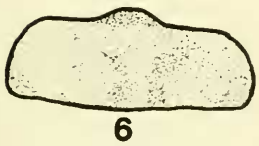


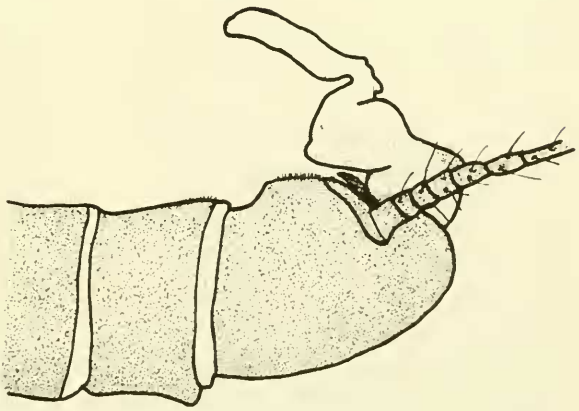










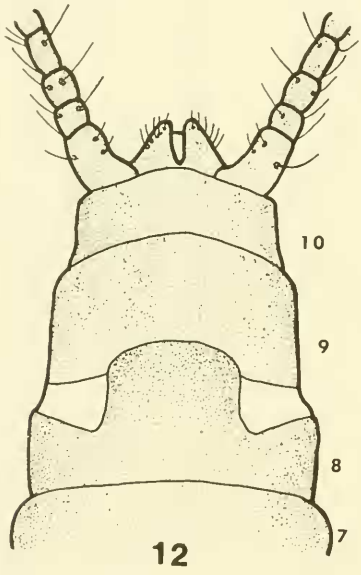


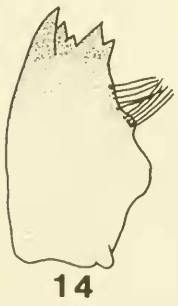
Figs. 4-11. *Isoperla* spp.: 4. *I. coushatta* adult female, ventral aspect of subgenital plate; 5-8. *I. coushatta* nymph, 5, maxilla, 6, labrum, 7, left mandible, 8, labium; 9-11, *I. jewetti* male terminalia, 9, ventral aspect, 10, dorsal aspect, 11, lateral aspect with aedeagus extruded.

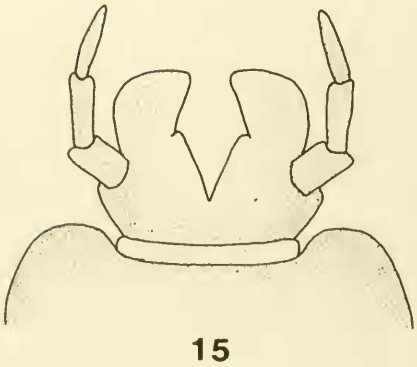
versity Museum, the Illinois Natural History Survey Museum, and in the personal collections of R. W. Baumann and S. W. Szczytko.

DISTRIBUTION.— *Oklahoma*—six counties: BRYAN, Blue River; CHEROKEE, 14-mile Creek; CHOCTAW, Clear Creek; HUGHES, Salt Creek; JOHNSON, Blue River, unnamed stream; PONTOTOC, Muddy Boggy Creek. *Texas*—fifteen counties: ANDERSON, unnamed stream, Saddler Creek (type locality); CASS, unnamed stream, Hughes Creek, Henderson Creek, Frazier Creek; CHEROKEE, unnamed stream, Keys Creek; HAMILTON, unnamed stream; HOUSTON, White Rock Creek; JASPER, Boykin Spring; LIBERTY, East Fork of San Jacinto River; MONTGOMERY, Caney Creek; NACOGDOCHES, Naconiche Creek, Yseleta Creek, unnamed stream; NEWTON, Little Cow Creek, Big Cow Creek; PANOLA, Murvaul Creek; POLK, Bear Creek, Big Creek; SABINE, unnamed stream; SHELBY, unnamed stream, Huana Creek; TYLER, unnamed stream, Big Cypress Creek.

DIAGNOSIS.— *Isoperla coushatta* is a noun in apposition and was chosen in honor of the Alabama-Coushatta Indian tribe that resided in Polk County, Texas, one of the first counties in which the species was collected. *I. coushatta* is most







Figs. 12-15. *Isoperla jewetti*: 12, female subgenital plate, ventral aspect; 13, maxilla of nymph; 14, left mandible of nymph; 15, labium of nymph.

closely related to *I. mohri*. Males can be distinguished from *I. mohri* by the shape of the ventral lobe on the eighth sternum (Figs. 3, 26), the lack of sclerotized digited fingers of the aedeagus (Figs. 27, 28), the longer, slender paraprocts, and the shape of the lobe on the eighth sternum. Females differ from *I. mohri* and *I. namata* by the shape of the subgenital plate (Figs. 4, 29; *I. namata* not illustrated). Mature nymphs can be distinguished from *I. mohri* and *I. namata* by the lack of paired dots and presence of five rather than three dorsal longitudinal abdominal stripes, with the median stripe being wider. Nymphs of *I. coushatta* differ from *I. mohri* also in that the lacinia has two apical teeth (Fig. 5) rather than one (Fig. 30), and the hairs are located only on the inner margin of the lacinia. The labrum is rectangular (Fig. 6) rather than broadly triangular as in *I. mohri* (Fig. 31). The paraglossae (Fig. 8) lack terminal nipples as in *I. mohri* (Fig. 32), and the mandibles (Fig. 7) bear five short teeth rather than two long ones as in *I. mohri* (Fig. 33).

Biology.— This species and *I. mohri* were tentatively referrred to as *I. namata* by Stewart et al. (1974). It is restricted to the forests east of the blackland prairie in Texas. Nymphs occur in the decaying leaves of small sandy-bottomed streams. We have been unable to find eggs in females up to six days of age. Males and females reared in the lab did not mate. Emergence occurs from early March to mid-April.

Isoperla jewetti, n. sp.

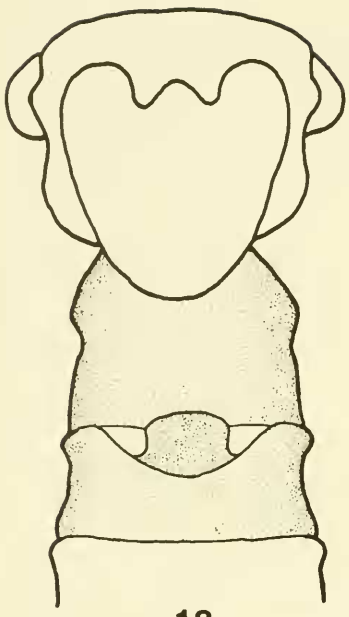
Isoperla longiseta: Frison, 1942. Bull. Ill. Natur. Hist. Surv. 22:318-320.

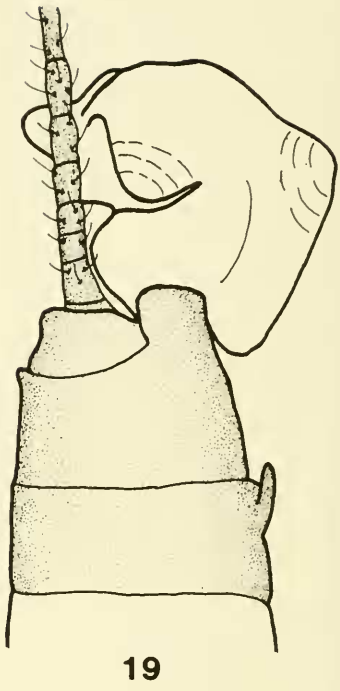
Male.— Body length 6.0-7.0 mm, to tip of wings 3.5-4.0 mm; sternum 8 with broadly rounded lobe (Fig. 9). Paraprocts short, stubby much like *I. mormona*. Patches of spinules on terga 9 and 10 (Fig. 10). Aedeagus membranous with long dorsal fingerlike process (Fig. 11).

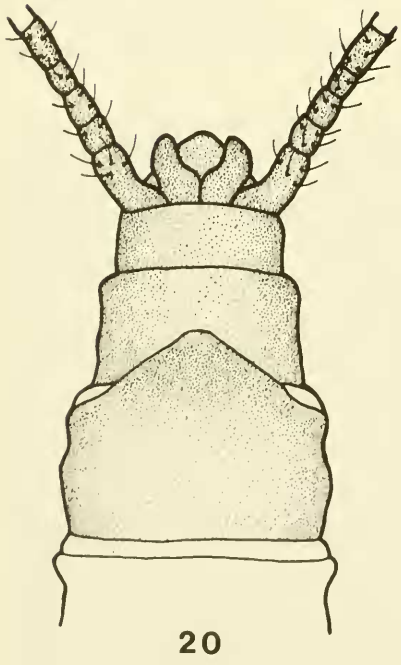
Female.— Body length 6.5-9.0 mm, to tip of wings 8.0-10.5 mm. Sternum 8 produced posteriorly into elongate-truncate subgenital plate produced slightly over sternum 9 (Fig. 12).

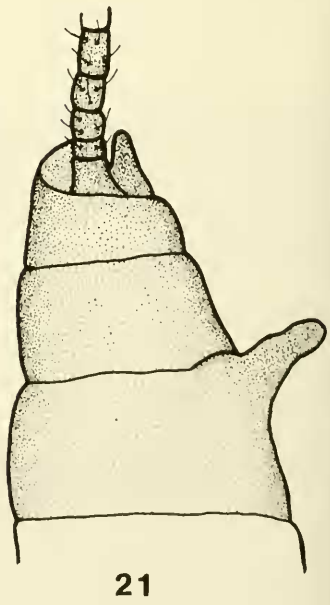
Nymph.— Nymph described here from exuviae. Lacinia with apical and subapical teeth, apical tooth slender, evenly tapering throughout length (Fig. 13). Mandibles with two prominent lobes on inner margin below bristles (Fig. 14). Paraglossae stout, truncate apically; prementum with wide V-shaped cleft (Fig. 15).

Figs. 16-17. *Isoperla* spp. eggs, scanning electron micrograph: 16, *I. jewetti*, photographed at 700X; 17, *I. longiseta*, photographed at 400X.









Figs. 18-21. *Isoperla sagittata* adult terminalia: 18, male with aedeagus extruded, ventral aspect; 19, male with aedeagus extruded, lateral aspect; 20, female, ventral aspect; 21, female, lateral aspect.

MATERIAL.— Male holotype, female allotype, 6 male, 17 female paratypes and 2 exuviae, 5-10 miles south of El Paso on road to Marathon in *Tamarix* along irrigation ditch, El Paso County, Texas, 22-IV-1939, J. A. and H. H. Ross.

The holotype, allotype, 4 male and 15 female paratypes, and 2 exuviae are deposited in the Illinois Natural History Survey Museum. Two paratypes, a male and a female, and one exuviae are deposited in the U.S. National Museum of Natural History. A similar deposit has been made in the North Texas State University Collection.

DISTRIBUTION.— *Texas*—one county: EL PASO, unnamed stream.

DIAGNOSIS.— Frison in 1942 identified the Texas specimens with some hesitation as *I. longiseta*, indicating that there were differences in the paraprocts and color pattern of the head, in addition to the brachypterous nature of the males. Stanley G. Jewett, Jr. of West Linn, Oregon, for whom the species is named, examined the specimens some time after Frison and indicated that they were closely related to *I. longiseta* (pers. corr.).

Males can be separated from *longiseta* by the shorter, stubbier paraprocts, and the fingerlike process dorsally on the aedeagus. The paraprocts of *I. longiseta* are long and slender, and the aedeagus has two dorsal lobes with a short process between them. Males differ from *I. mormona* by having more slender paraprocts and a broader lobe on sternum 8 which is rounded posteriorly; this lobe is square shaped and narrow at the base in *I. mormona*. Only the holotype has the aedeagus extruded. We attempted to manually evert the aedeagus of two other males but found them too fragile due to the long period in preservative. We found no characters to separate females of *I. jewetti* from *I. longiseta*. Females of *I. jewetti* can be separated from *I. mormona* by the shape of the subgenital plate. In *I. jewetti* as in *I. longiseta* it is truncate and produced over about one-fourth of sternum 9, whereas in *I. mormona* it is not produced and is usually emarginate.

The eggs of *I. jewetti*, obtained from preserved females, are smaller, 200 μ width x 300 μ length, (Fig. 16) than those of *I. longiseta*, 270 μ width x 380 μ length (Fig. 17). Their sperm guides are irregularly spaced near the equator of the eggs (Figs. 16, 17). The sperm guides of *I. longiseta* are 0.9066 μ in length, whereas those of *I. jewetti* are 0.3600 μ. The crown area of the *I. longiseta* egg is more well developed (Fig. 17) and elevated than in *I. jewetti* (Fig. 16). The chorionic sculpturing is similar in both species.

The one male specimen from Colorado previously mentioned is very similar to *I. jewetti*. Since a revision of the western *Isoperla* is underway by the authors, the status of this Colorado population will be reserved until the revision is completed.

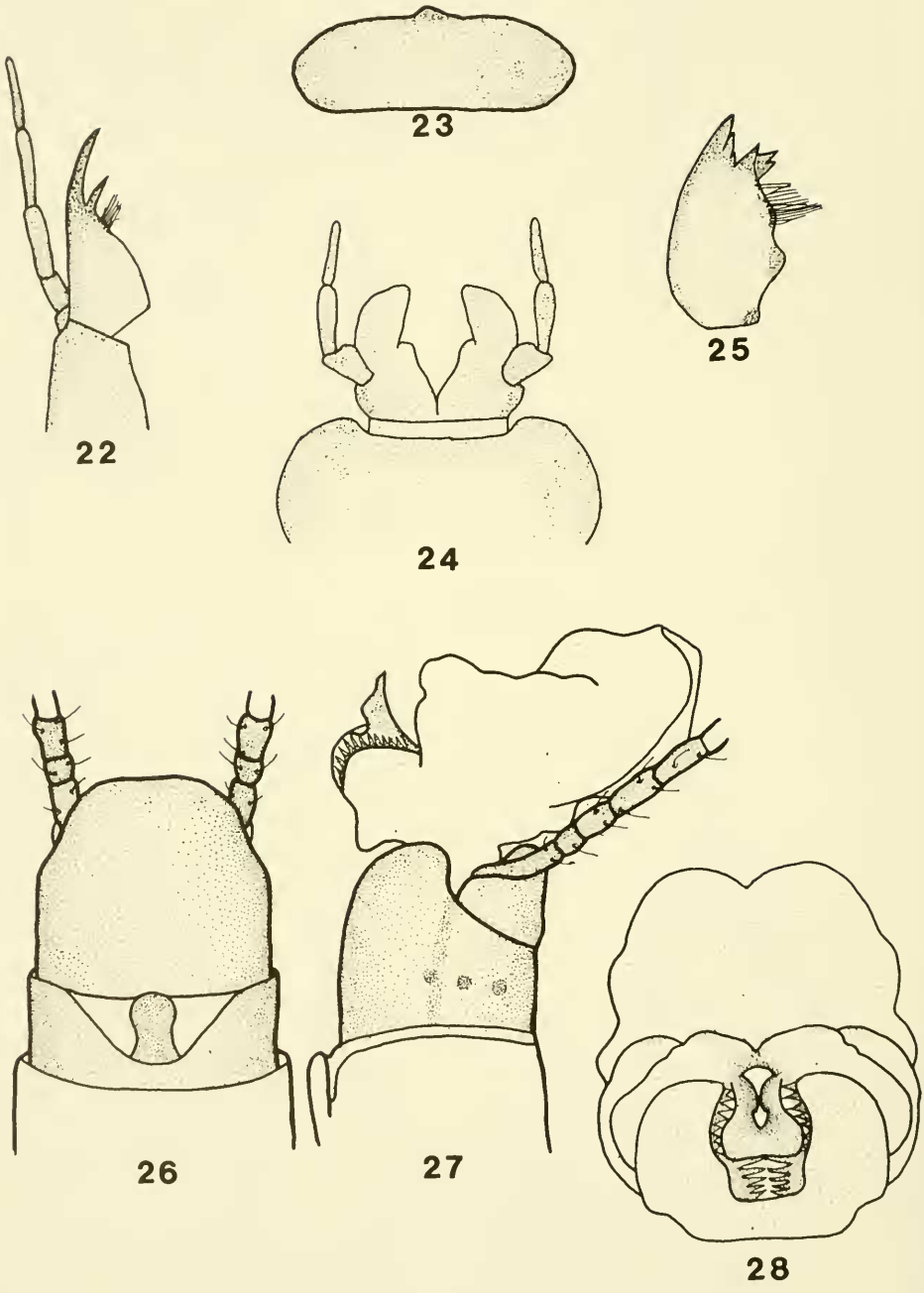
BIOLOGY.— This species apparently emerges in the middle of April. We have attempted without success to collect additional specimens. This population may now be extinct due to the heavy use of pesticides in the irrigation ditches and canals in that area.

Isoperla sagittata, n. sp.

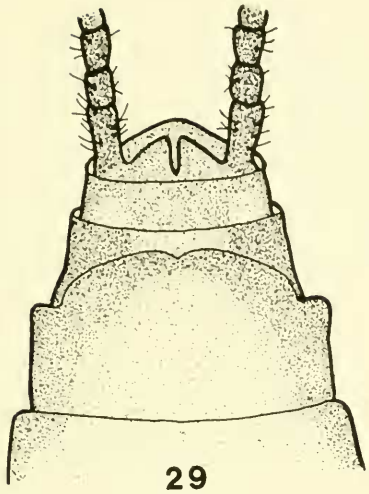
MALE.— Body length 6.5-7.5 mm, to tip of wings 9.0-9.5 mm. Lobe on posterior abdominal sternum 8 wide at base with truncate apex (Fig. 18). Paraprocts reduced, not curving upward to posterior margin of tergum 10. Aedeagus entirely membranous with median dorsal lobe and two dorsolateral lobes (Figs. 18, 19), its ventrum with elevated sagittate region (Fig. 18). Abdomen bright orange red, with one prominent dorsomedian longitudinal dark stripe and two faint lateral stripes. Head pattern variable, usually with dark triangle between ocelli.

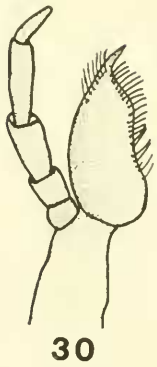
FEMALE.— Body length 7.0-8.0 mm, to tip of wings 9.0-10.0 mm. Eighth sternum posteriorly produced into triangular subgenital plate (Fig. 20), covering approximately one-half sternum 9; plate produced downward about 90 degrees (Fig. 21). Color pattern similar to male but duller.

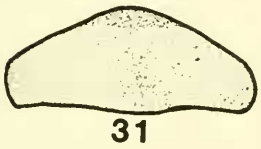
NYMPH.— Abdomen with dark median longitudinal stripe and two faint lateral stripes. Usually one, sometimes three rows faint dots associated with each lateral stripe; one row black dots on median stripe. Head and pronotum mostly concolorus, without distinct pattern. Pronotum with long hairs around margins. Lacinia bidentate; apical tooth long, subapical tooth about one-half length of api-

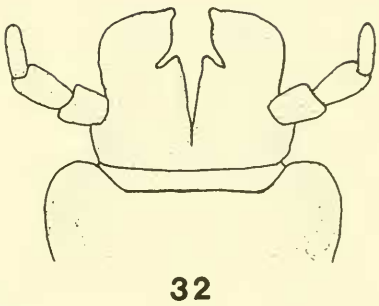


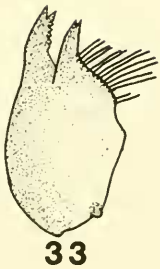
Figs. 22-28. *Isoperla* spp.: 22-25, *I. sagittata* nymph, 22, maxilla, 23, labrum, 24, labium, 25, left mandible; 26-28, *I. mohri* male terminalia, 26, ventral aspect, 27, lateral aspect, aedeagus extruded, 28, aedeagus, ventral aspect.











Figs. 29-33. *Isoperla mohri*: 29, adult female terminalia, ventral aspect; 30, maxilla of nymph; 31, labrum of nymph; 32, labium of nymph; 33, left mandible of nymph.

cal tooth. Small tuft of setae below subapical tooth (Fig. 22). Labrum rectangular with small median hump (Fig. 23). Cleft between glossae wide (Fig. 24). Left mandible with three teeth, first tooth long and slender, second about three-fourths length of first, third tooth bidentate with small lobe on inside margin (Fig. 25).

MATERIAL.— Male holotype, female allotype, 2 male, 3 female and 3 nymph paratypes, and 9 exuviae. Little Cow Creek, Newton County, Texas, 28-II-1975, S. W. Szczytko and K. W. Stewart. The holotype, allotype, and one nymph are deposited in the U.S. National Museum of Natural History. Three paratypes, a male, a female, and a nymph, are deposited in the Illinois Natural History Survey Museum. The North Texas State University Collection has received a similar deposit.

DISTRIBUTION.— *Texas*—one county: NEWTON, Little Cow Creek.

DIAGNOSIS.— The species name is descriptive of the raised area on the venter

of the aedeagus. We compared adults and nymphs with Frison's paratypes of *I. burksi* from Lusk Creek, Eddyville, Illinois, and his species lacks this sagittate area. The female subgenital plate lacks the deep notch that is characteristic in *I. burksi*, and it is produced downward to near 90 degrees of the body axis, unlike *I. burksi* (Frison 1942: Fig. 110). Nymphs of *I. sagittata* differ from those of *I. burksi* by having dorsal longitudinal stripes rather than transverse dark bands; the subapical tooth of the lacinia is shorter, being approximately one-fourth to one-half the length of the apical tooth, whereas in *I. burksi* it is approximately three-fourths the length of the apical tooth.

Biology.— This species is known only from a single locality in southeast Texas. Nymphs were collected in a swift, sandy-bottomed stream in decaying leaves and debris. Adults were collected in low-lying vegetation near the stream edge. *Paragnetina fumosa*, *Acroneuria arenosa*, *Perlesta placida*, and *Isoperla coushatta* were also found in the same stream. One female dissected at the age of three days contained no eggs.

Adults emerge for a very short period in February. Adults and nymphs appear to be rare and are difficult to collect.

Literature Cited

Frison, T. H. 1935. The stoneflies (Plecoptera) of Illinois. Ill. Natur. Hist. Surv. Bull. 20: 455-459.

———. 1942. Studies of North American Plecoptera. Ill. Natur. Hist. Surv. Bull. 22:318-321.

Stewart, K. W., R. W. Baumann, and B. P. Stark. 1974. The distribution and past dispersal of southwestern United States Plecoptera. Trans. Amer. Entomol. Soc. 99: 507-546.